REMARKS

This is in response to the final Office Action mailed on December 18, 2006, in which claims 1-3 and 7-15 were rejected under 35 U.S.C. § 102(e) as being anticipated by Lin et al. (U.S. Pat. App. Pub. 2003/0189798); and claims 4-6 and 17 were rejected under U.S.C. § 103 as being unpatentable over Lin et al. With this Amendment, claims 1, 3, 8, 10, and 14 are amended. Claims 1-24 are pending in the present application.

<u>Claims 1-10</u>

Claims 1-3 and 7-10 were rejected under 35 U.S.C. § 102(e) as being anticipated by Lin et al. In order to reject a claim under § 102(e), the reference must teach each and every limitation of the claims. MPEP 2131; *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 2 USPQ2d 1051 (Fed. Cir. 1987). With this Amendment, claims 2 and 9 are canceled, and claims 1, 3, 8, and 10 are amended. Amended claim 1 recites a magnetic sensor comprising "a sensor stack having a physical width with a corresponding electrical width and a physical height with a corresponding electrical height." The magnetic sensor of amended claim 1 also includes "means for providing an electric field that creates a charge carrier depleted region in the sensor stack such that at least one of (a) the electrical width is smaller than the physical width and (b) the electrical height is smaller than the physical height." The amendments to claim 1 further clarify how the physical and electrical dimensions of the sensor stack are related to each other by explicitly laying out that the physical and electrical widths of the sensor stack correspond to each other and the physical and electrical heights of the sensor stack correspond to each other. Editorial amendments are made to claims 3, 8, and 10 to update their dependency and cure antecedent basis issues based on the cancellation of claims 2 and 9.

Lin et al. teach a GMR read head 200 including a read sensor 204 and a longitudinal bias (LB) stack 208 in a read region 212. Paragraph 0029. A monolayer photoresist 260 is deposited, exposed, and developed in order to open the read trench region 212 for the definition of a read width. By then reactive ion etching first conductor layer 236, two spaced apart portions 262 of first conductor layer 236 are created, each having a sharply defined opposing face 292 that serves to help define the read width 212 of the GMR read head 200. Paragraph 0031. "The designed read

width 212 can be substantially unambiguously attained since three factors for defining the boundary between the read and overlay regions, one physically by the monolayer photoresist width, one magnetically by the LB stack, and the third electrically by the first conductor, *all lead to a substantially identical read width 212.*" Paragraph 0031, emphasis added. In other words, GMR read head 200 is designed such that the physical read width is identical to the electrical read width. This accomplishes the stated goal of Lin et al., which is to sharply define the boundaries between the read and overlay regions. Paragraph 0008. However, Lin et al. **do not** disclose that spaced apart portions 262, second conductor layer 280, or any other portion of GMR read sensor 204 <u>provides an electric field that creates a charge carrier depleted region</u> in the GMR read sensor 204 such that at least one of (a) the electrical width is smaller than the physical width and (b) the electrical height is smaller than the physical height, as is recited in claim 1.

The Office Action refers to paragraphs 0004 and 0008 of Lin et al. in rejecting claim 1, but neither of these paragraphs, either alone or in combination with any other paragraph in Lin et al., discloses all the recited elements of claim 1. Paragraph 0004 gives background information about how one way to improve the performance of hard disk drives is to increase the areal data storage density of the magnetic hard disk, which can be accomplished by developing a sufficiently narrow read head having a narrow read width. This, of course, is the goal of most magnetic sensors since this allows for the development of magnetic recording systems having higher storage capacities. However, what Applicants claim and what is novel over the prior art is the concept of incorporating "means for providing an electric field that creates a charge carrier depleted region in the sensor stack such that at least one of (a) the electrical width is smaller than the physical width and (b) the electrical height is smaller than the physical height," as recited by claim 1. Paragraph 0004 of Lin et al. does not provide anything that can be fairly interpreted to teach or disclose this concept.

Paragraph 0008 of Lin is the first paragraph of the summary of the invention section and generally sets forth the structure, operation, and fabrication of the magnetic head as disclosed in the detailed description (which, as described above, does not teach all elements of claim 1). As stated in the first sentence of paragraph 0008, the giant magnetoresistance (GMR) read head has a

"reactive-ion-etch (RIE) defined read width." RIE is a fabrication technique that is used to define the physical boundaries of an intricate structure, and has nothing to do with producing an electrical dimension that is smaller than a corresponding physical dimension. The GMR read head includes "a GMR read sensor and a longitudinal bias (LB) stack in a read region," and in some embodiments a first conductor in two overlay regions. The GMR read sensor in the read region is active since the sense-layer magnetization can be rotated in response to signal fields, while the GMR sensor in the two overlay regions is inactive. Consequently, "a read width is sharply defined by the boundaries between the read and overlay regions." In other words, the physical boundary between the active read region and the inactive overlay region defines the read width. Thus, paragraph 0008, either alone or in combination with the teachings of paragraph 0004, does not teach or even fairly suggest "means for providing an electric field that creates a charge carrier depleted region in the sensor stack such that at least one of (a) the electrical width is smaller than the physical width and (b) the electrical height is smaller than the physical height" as recited by claim 1. Therefore, because the recited elements of claim 1 are not disclosed by the prior art, the rejection to claim 1 under 35 U.S.C. § 102(e) should be withdrawn.

Claims 2, 3, and 7-10 were also rejected under 35 U.S.C. § 102(e) as being anticipated by Lin et al. Claims 2, 3, and 7-10 depend from claim 1. As discussed above, claim 1 is not anticipated or otherwise taught by Lin et al. Therefore, claims 2, 3, and 7-10 are also not anticipated or otherwise taught by Lin et al.

Claims 4-6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin et al. Claims 4-6 depend from allowable claim 1, and as such are allowable with their respective independent base claims. In addition, it is respectfully submitted that the combinations of features recited in claims 4-6 are patentable on their own merits, although this does not need to be specifically addressed herein since any claim depending from a patentable independent claim is also patentable. See MPEP 2143.03, citing *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

Claims 11-24

Claims 11-15 were rejected under 35 U.S.C. § 102(e) as being anticipated by Lin et al. Claim 11 recites a magnetoresistive read head comprising a magnetoresistive stack and "a first bias electrode positioned with respect to the magnetoresistive stack such that a read width of the magnetoresistive stack is a function of a bias voltage applied to the first bias electrode." This allows the resolution of the sensor to be increased without requiring adjustment of intricate physical dimensions. Page 6, lines 3-6 of the present application.

Lin et al. teach a GMR read head 200 including a read sensor 204 and a longitudinal bias (LB) stack 208 in a read region 212. Paragraph 0029. While the Office Action does not specifically address which structures in read head 200 teach the first bias electrode recited in claim 11, the Office Action does refer to first two spaced apart portions 262 of first conductor layer 236 and second conductor layer 280 as satisfying the bias electrode limitations of claims that depend from claim 11. The description of second conductor layer 280 is extremely limited, but there is no disclosure related to applying a bias voltage to this portion of read head 200, or that the read width of the read width of read sensor 204 is a function of an applied bias voltage. Two spaced apart portions 262 are formed by reactive ion etching (RIE) first conductor layer 236, each spaced apart portion 262 having a sharply defined opposing face 292 that serves to help define the read width 212 of the GMR read head 200. Paragraph 0031. The use of spaced apart portions 262 in overlay region 276 leads to substantial current shunting, which induces a magnetic field strong enough to align M_1 in the two overlay regions 276 in a direction perpendicular to the ABS. Paragraph 0032. "The designed read width 212 can be substantially unambiguously attained since three factors for defining the boundary between the read and overlay regions, one physically by the monolayer photoresist width, one magnetically by the LB stack, and the third electrically by the first conductor [236], *all lead to a substantially identical read width 212.*" Paragraph 0031, emphasis added. In other words, GMR read head 200 is designed such that the physical read width is identical to the electrical read width. Lin et al. do not disclose that a bias voltage is even applied to any portion of spaced apart portions 262 or second conductor layer 280, much less that the read width of GMR read sensor 204 is a

function of a bias voltage applied to spaced apart portions 262, second conductor layer 280, or any other portion of GMR read sensor 204.

The Office Action refers to paragraphs 0004 and 0008 of Lin et al. in rejecting claim 11, but neither of these paragraphs, either alone or in combination with any other paragraph in Lin et al., discloses all the recited elements of claim 11. As set forth above with regard to the discussion of claim 1, paragraph 0004 gives background information about how one way to improve the performance of hard disk drives is to increase the areal data storage density of the magnetic hard disk, which can be accomplished by developing a sufficiently narrow read head having a narrow read width. However, what Applicants claim and what is novel over the prior art is the concept of positioning a first bias electrode with respect to the magnetoresistive stack "such that a read width of the magnetoresistive stack is a function of a bias voltage applied to the first bias electrode" as recited by claim 11. Lin's teaching of the general desirability of a narrow read width does not teach the specific structure defined by claim 11. Thus, paragraph 0004 of Lin et al. does not provide anything that can be fairly interpreted to teach or disclose the concept recited by claim 11.

Paragraph 0008 is the first paragraph of the summary of the invention section and generally sets forth the structure, operation, and fabrication of the magnetic head as disclosed in the detailed description. As stated in the first sentence of paragraph 0008, the giant magnetoresistance (GMR) read head has a "reactive-ion-etch (RIE) defined read width." RIE is a fabrication technique that is used to define the physical boundaries of an intricate structure. The GMR read head includes "a GMR read sensor and a longitudinal bias (LB) stack in a read region," and in some embodiments a first conductor in two overlay regions. The GMR read sensor in the read region is active since the sense-layer magnetization can be rotated in response to signal fields, while the GMR sensor in the two overlay regions is inactive. Consequently, "a read width is sharply defined by the boundaries between the read and overlay regions." In other words, the read width is not a function of a bias voltage applied to a first bias electrode. Thus, paragraph 0008, either alone or in combination with the teachings of paragraph 0004, do not teach or even fairly suggest the recited elements of claim 11. Therefore, because the recited elements of claim 11 are not disclosed by the prior art, the rejection to claim 11 under 35 U.S.C. § 102(e) should be withdrawn.

Claims 12-15 were also rejected under 35 U.S.C. § 102(e) as being anticipated by Lin et al. Claims 12-15 depend from claim 11. As discussed above, claim 11 is not anticipated or otherwise taught by Lin et al. Therefore, claims 12-15 are also not anticipated or otherwise taught by Lin et al.

Claim 17 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin et al. Claim 17 depends from allowable claim 11, and as such is allowable therewith. In addition, it is respectfully submitted that the combination of features recited in claim 17 is patentable on its own merits, although this does not need to be specifically addressed herein since any claim depending from a patentable independent claim is also patentable. See MPEP 2143.03, citing In re Fine, 837 F.2d 1071 (Fed. Cir. 1988).

Claims 18-24 were previously withdrawn from consideration as being drawn to a non-elected species. Claims 18-24 depend from allowable independent claim 11. Thus, claim 18-24 should also be considered and allowed, since they depend from an allowable generic independent claim. See MPEP 809.02 and 37 C.F.R. 1.146.

CONCLUSION

In view of the foregoing, it is believed that all claims in the present application are in condition for allowance. Reconsideration and allowance of claims 1-17 are respectfully requested. In addition, claims 18-24 should also be considered and allowed, since they depend from allowable generic independent claim 11. A Notice of Allowance with respect to all claims 1-24 is respectfully requested.

Respectfully submitted,

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